

REMARKS

Claims 1, 4 and 6 have been amended. Claims 1 and 4 have been amended to clarify the language of the claim. Support for the claim amendments may be found, for example, at page1, lines 5-7 of the specification. Claims 4 and 6 have been amended to correct typographical errors. No new matter has been added.

Claims 1-6 are pending.

CLAIM OBJECTIONS

The Examiner has objected to claims 4 and 6 for informalities. See Office Action at p. 2. Applicants have amended claim 4 to correct the typographical error in "mass electing." Applicants have also amended claim 6 to change the comma at the end of line 2 to a period. Applicants respectfully request the withdrawal of this objection.

CLAIM REJECTIONS

Rejection under 35 U.S.C. § 112

The Examiner has rejected claims 1-6 under 35 U.S.C. § 112, second paragraph as being indefinite. See Office Action at p. 2. Specifically, the Examiner alleges that claims 1 and 4 are indefinite as "the limitation 'consisting of alkanes, ethane or ethyne ... implies that the gases only contain alkanes, ethane, or ethyne only.'" *Id.* Applicants have amended independent claims 1 and 4 and removed the term "consisting" from the claims. Claim 1 now relates to a method of detecting and quantifying trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne. Claim 4 now relates to a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer. Applicants believe that claims 1 and 4 are clear and that the claims as a whole, would apprise one of skill in the art of their scope. Applicants respectfully request reconsideration and the withdrawal of this rejection.

Rejection under 35 U.S.C. § 103

Keough and Zhu

The Examiner has rejected claims 1-3 under 35 U.S.C. § 103(a) as being unpatentable over Keough (*Anal. Chem.*, Vol. 54, p. 2540-2547 (1982)) ("Keough") and further in view of Zhu et al. (*Int J Mass Spectrom.*, Vol. 194, p. 93-101 (2000)) ("Zhu"). See Office Action at p. 3. Claims 2-3 depend from independent claim 1.

Claim 1 relates to a method of detecting and quantifying trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne, the method including using an alkoxyalkyl cation as the chemical ionisation precursor in a selected ion flow tube mass spectrometer. As described in the specification, the detection method permits reaction with the sulphur-containing or other added material but does not react with the bulk gas or with the major constituents of air. See, for example, p. 5, line 13 to p. 6, line 2 of the specification. Because of these findings, methoxymethyl cation can be used to monitor odorant molecules. Id.

In contrast, Keough subjects dimethyl ether to electron impact and uses the ions generated $C_2H_5O^+$ and $C_2H_7O^+$ as chemical ionization agents to distinguish between a number of different hydrocarbons including for example, alkenes and cycloalkenes, conjugated and non-conjugated dienes. See abstract on p. 2540 of Keough. In other words, Keough is using these ions to **distinguish** between different hydrocarbons whereas the present application uses the methoxymethyl cation because it **does not react** with small saturated hydrocarbons. See for example, Table 1 on p. 4 of the specification. As such, Keough does not teach or suggest a method of detecting and quantifying trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne, the method including using an alkoxyalkyl cation as the chemical ionisation precursor in a selected ion flow tube mass spectrometer.

Such a defect is not remedied in Zhu. As stated by the Examiner, Zhu describes "a method of analyzing a gas sample using selected ion flow tube mass spectroscopy ... using dimethyl ether as the chemical ionization precursor." See Office Action at p. 4. Zhu does not teach or suggest a method of detecting and quantifying trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or

ethyne, the method including using an alkoxyalkyl cation as the chemical ionisation precursor in a selected ion flow tube mass spectrometer.

Accordingly, none of the above-mentioned references, alone or in combination, teach or suggest a method of detecting and quantifying trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne, the method including using an alkoxyalkyl cation as the chemical ionisation precursor in a selected ion flow tube mass spectrometer.

Since claims 2-3 depend on claim 1, claims 2-3 are also patentable over the combination of Keough and Zhu for at least the reasons described above. Applicants respectfully request reconsideration and withdrawal of this rejection

Keough in view of Zhu and Freitas

The Examiner has further rejected claims 4-6 under 35 U.S.C. § 103(a) as being unpatentable over Keough in view of Zhu and further in view of Freitas et al. (*Int J Mass Spectrom.*, Vol. 175, p. 107-122 (1998)) ("Freitas"). See Office Action at p. 5. Claims 5-6 depend from independent claim 4.

Claim 4 relates to a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer that include the steps of: producing a supply of alkyoxymethyl cations, mass selecting the alkyoxymethyl cations, inducing a flow of the alkyoxymethyl cations into the inlet of a flow tube of the spectrometer in a carrier flow of helium reacting the gas sample with the alkyoxymethyl cations, analysing the reacted gas sample in the mass spectrometer, and calculating the concentration of the trace levels of molecules containing heteroatoms present in the reacted gas sample.

As previously explained, Keough uses $\text{C}_2\text{H}_5\text{O}^+$ and $\text{C}_2\text{H}_7\text{O}^+$ as chemical ionization agents to **distinguish** between different hydrocarbons whereas the present application uses the methoxymethyl cation because it *does not react* with small saturated hydrocarbons. See for example, Table 1 on p. 4 of the specification. Keough does not teach or suggest a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or

more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer that include reacting the gas sample with the alkyoxymethyl cations, analysing the reacted gas sample in the mass spectrometer, and calculating the concentration of the trace levels of molecules containing heteroatoms present in the reacted gas sample.

Such a defect is not remedied in Zhu or Freitas either. Zhu describes “a method of analyzing a gas sample using selected ion flow tube mass spectroscopy ... using dimethyl ether as the chemical ionization precursor.” See Office Action at p. 4. Zhu does not teach or suggest a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer that include reacting the gas sample with the alkyoxymethyl cations, analysing the reacted gas sample in the mass spectrometer, and calculating the concentration of the trace levels of molecules containing heteroatoms present in the reacted gas sample.

Freitas describes the “gas phase reactivity of the methoxymethyl cation.” See abstract of Freitas. Freitas does not teach or suggest a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer that include reacting the gas sample with the alkyoxymethyl cations, analysing the reacted gas sample in the mass spectrometer, and calculating the concentration of the trace levels of molecules containing heteroatoms present in the reacted gas sample.

Accordingly, none of the above-mentioned references, alone or in combination, teach or suggest a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer that include reacting the gas sample with the alkyoxymethyl cations, analysing the reacted gas sample in the mass spectrometer, and calculating the concentration of the trace levels of molecules containing heteroatoms present in the reacted gas sample.

Applicant : McEwan et al.
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Since claims 5-6 depend on claim 4, claims 5-6 are also patentable over the combination of Keough, Zhu and Freitas for at least the reasons described above. Applicants respectfully request reconsideration and withdrawal of this rejection

CONCLUSION

Applicant believes that the claims are in condition for allowance. Should any fees be required by the present Reply, the Commissioner is hereby authorized to charge Deposit Account 19-4293.

Respectfully submitted,

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